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## Fears of cooling with outside air may be unfounded

By Mark Fontecchio, News Writer
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The Lawrence Berkeley National Laboratory is studying the use of outside air to cool the data center, focusing on whether two common fears – contaminants and humidity entering the room – are justified.

The study is being sponsored by Northern California utility Pacific Gas & Electric Co., (PG&E) which offers rebates to customers who install outside air economizers in their data centers. An economizer is comprised of a sensor and filter, and allows outside air to come inside when conditions, such as temperature and humidity, are right.

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William Tschudi, project manager in Lawrence Berkeley's environment energy technologies division, said the study includes seven data centers. Two of them will provide solid comparative data because they're in the process of installing economizers, providing the lab with before and after measurements. The study started in April and should be done by the end of this year.

According to The Uptime Institute, for every 3Ws of electricity that come into most data centers, only 1W gets to the computer equipment. The other 2Ws are spent on cooling and inefficient operations, such as poor air flow.

If data centers could pump naturally cool outside air into their facility, they could save money. How much money depends largely on geography, as data centers in warmer climates wouldn't be able to use as much outside air. But Tschudi said that even in those areas, temperatures drop enough at night to allow cool air to be pumped in some of the time.

"You can get huge energy savings because you're not using a chiller or compressor to provide cooling," Tschudi said. "In a lot of climates, you can get quite a few hours of outside air cooling."

Network Appliance Inc. (NetApp), a Sunnyvale, Calif.-based network storage company, is one of the study participants. NetApp built a new data center at its headquarters three years ago and designed it to handle outside air economizers. The 6,000-square-foot data center room is in an interior zone that doesn't touch the exterior walls. Facilities director Dan Hoffman said it was built that way for security reasons and to avoid contact between the data center room and the outside environment, which could cause temperatures to fluctuate.

Between the data center room and the exterior walls is a space with air handlers that blow cool air to the data center and hot air outside. The data center room also has overhead cooling that exempts them from having a raised floor. With this system, Hoffman can control how much cooling comes from outside air and how much from mechanical refrigeration.

To cleanse the outside air, NetApp uses the same kind of commercial pleated air filters they'd use in regular office space, and they haven't seen "dirt building up on the equipment or fatalities on the equipment," Hoffman said. The Lawrence Berkeley lab has also measured contaminant levels in the data center and found them to be well below maximum thresholds.

NetApp hasn't measured exactly how much money the cooling system has saved them, but Hoffman said it was a "huge energy savings" and estimated that they've probably cut cooling costs by one-third.

"We are trending the economizer use," he said. "We're bringing in more software tools to track that data. Part of the work with Lawrence Berkeley labs is getting the data to monitor that."

But cooling with outside air is still a tough sell, as the sponsor of the study readily admits. Mark Bramfitt, PG&E's supervisor of the customer energy efficiency program for the high tech market, said in an interview last week that data centers are worried about changing their power and cooling infrastructure systems. The hope of the company is that the results of the Lawrence Berkeley labs study will convince more data centers to try it out. PG&E also offers rebates for data centers that use Sun Microsystems Inc.'s energy-friendly Niagara T1000 and T2000 servers and for virtualization projects.

For this study, the Lawrence Berkeley lab started by researching what contaminants could cause problems. One thing it found is that certain compounds called hygroscopic salts, when combined with high humidity, could cause equipment to short out. But Tschudi claimed that the normal filtration system in a data center "does a pretty good job of getting the larger particles out."

"We haven't studied every combination you might get," he said. "If there's a data center next to a really polluted environment, that's different. But I think the story coming out of this is that we'll have some data that shows that there doesn't need to be so much

concern about contaminants."

Don Beaty, president of engineering consultant company DLB Associates and member of the technical committee for the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), said the lures of using outside air are compelling, but there are reasons to be wary.

"Essentially, transferring outside air directly to the data center essentially means that it is unconditioned," he wrote in an email. "This can cause humidity issues. Also, contaminants can be introduced through outside air, such as pollen, construction dust, etc."

Even if the economizers are installed and work properly, Beaty added that "some of the energy savings can be lost due to increase(d) fan horsepower to compensate for the resistance of the filtration system or heat exchanger."

But he said saving money is definitely a possibility. Data centers need to study the local climate to determine how many hours per year it would take to support the use of an economizer and what the ends of the temperature spectrum are because they can affect how much mechanical refrigeration will be needed.

*Let us know what you think about the story; e-mail:* [Mark Fontecchio, News Writer](#)

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